

WHAT IS CLAIMED IS:

Sub A' →

1. A dual mode band-pass filter comprising:
a dielectric substrate having first and second main surfaces;
a metallic film having an opening for coupling two resonance modes and disposed in the first main surface of the dielectric substrate or inside of the dielectric substrate;
at least one ground electrode disposed on the second main surface of the dielectric substrate or inside of the dielectric substrate, so as to be opposed to the metallic film through a dielectric layer; and
a pair of input-output coupling circuits connected to different portions of the metallic film.

2. A dual mode band-pass filter according to claim 1, wherein the opening has a plan shape containing a longitudinal dimension and a width dimension.

3. A dual mode band-pass filter according to claim 2, wherein the plan shape of the opening is one of a rectangle, an ellipse, and a configuration including one of a rectangle and an ellipse having a bent portion thereof that elongates in a direction intersecting the longitudinal dimension.

4. A dual mode band-pass filter according to claim 1, wherein the plan shape of the metallic film is one of a rectangle, a rhombus, a regular polygon, a circle, and an ellipse.

5. A dual mode band-pass filter according to claim 1, wherein a plurality of openings are formed in the metallic film.

6. A dual mode band-pass filter according to claim 1, wherein the metallic film is disposed on the first main surface of the dielectric substrate, and the ground electrode is disposed on the second main surface of the dielectric substrate.

7. A dual mode band-pass filter according to claim 1, wherein the metallic film is disposed at a vertical level inside of the dielectric substrate, and the ground electrodes are disposed on the first and second main surfaces of the dielectric substrate, whereby the band-pass filter has a tri-plate structure.

8. A dual mode band-pass filter according to claim 1, wherein the two resonance modes have resonance directions

that cross each other at a right angle.

9. A dual mode band-pass filter according to claim 8, wherein the two resonance modes have different resonance frequencies from each other.

10. A dual mode band-pass filter according to claim 1, wherein the dielectric substrate is substantially rectangular.

11. A dual mode band-pass filter according to claim 1, wherein the metallic film is provided partially on the first main surface of the dielectric substrate.

12. A dual mode band-pass filter according to claim 1, wherein the metallic film and the opening in the metallic film have substantially the same shape.

13. A dual mode band-pass filter according to claim 1, wherein the metallic film is made of copper.

14. A dual mode band-pass filter according to claim 1, wherein the resonance modes include a first resonance mode is a $\lambda/2$ resonance mode having a resonator length that is the length in the longer side direction of the metallic film

and a second resonance mode that is a $\lambda/2$ resonance mode having a resonator length that is the length in the shorter side direction of the metallic film.

Sub A2 → 15. A dual mode band-pass filter according to claim 1, wherein the opening is arranged such that the resonance modes are approximately equal to each other.

16. A dual mode band-pass filter according to claim 1, wherein the metallic film has longer and shorter sides, and the input-output coupling circuits are connected to one of the longer sides of the metallic film.

17. A dual mode band-pass filter according to claim 1, wherein the input-output coupling circuits are connected to the metallic film at positions opposed to each other on the outer side of the portion of the metallic film where the opening is formed, in a direction that is substantially perpendicular to the lengthwise direction of the opening.

18. A dual mode band-pass filter according to claim 1, wherein the input-output coupling circuits are connected to the metallic film at positions that define a center angle of about 90° with respect to the metallic film.

19. A dual mode band-pass filter according to claim 1, wherein the input-output coupling circuits are connected to the metallic film at positions that define a center angle that is different than 90° with respect to the metallic film.

20. A dual mode band-pass filter according to claim 1, wherein the metallic film and the opening in the metallic film have different shapes.